AMERICAN MUSEUM NOVITATES

Published by
Number 1325 THE AMERICAN MUSEUM OF NATURAL HISTORY September 16, 1946
New York City

PARAFUSULINA FROM THE PERMIAN OF ALASKA

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This study is based upon a chunk of "*Fusulina*-limestone" in the collections of the American Museum of Natural History derived from Kuiu Island, Alaska. It was collected and presented to the Museum by Mr. J. H. Wandve of Ketchikan, Alaska, and was kindly lent to me for study by Dr. Otto Haas.

Kuiu is an island some 50 miles in length, lying about midway between Sitka and Ketchikan in the southern half of the panhandle of Alaska. As mapped by F. E. and C. H. Wright in their study of the Ketchikan and Wrangell Mining Districts,[1] it is almost entirely occupied by deformed Paleozoic sediments. In the report cited (*ibid.*, pp. 54–55), Girty reported on two "Carboniferous" faunas from Halleck Harbor near the north end of Saginaw Bay on Kuiu Island. The exposed section there measured about 575 feet thick and consists of a lower division of black shale, calcareous sandstone, and conglomerate, totaling about 125 feet thick, and an upper division of white cherty limestone some 450 feet thick. From the lower division Girty had a fauna of 22 forms, mostly unidentified as to species. Among these was listed "*Fusulina* aff. *F. longissima* Moell." which is in all probability the form now before us. It may be significant that among the associated brachiopods Girty listed *Productus* aff. *humboldti* D'Orbigny, *Productus* aff. *porrectus* Kutorga, and *Productus* aff. *schrenki* Stuckenberg. All three of the named species are from strata now recognized as Permian.

It is also interesting that in the overlying limestone, which Girty labeled as the "upper division of upper Carboniferous," he listed several brachiopods having affinity with species from the Permian of Russia, notably *Productus* aff. *timanicus* Stuckenberg, *Productus* aff. *aagardi* Toula, *Productus* aff. *gruenewaldti* Stuckenberg, and *Productus* aff. *mammatus* Keys. These suggest comparison with the Permian faunas of Spitzbergen and East Greenland which now appear to be of upper Permian age.

The fusulines before us are embedded in sedimentary hematite which not only surrounds but largely fills them. The shells are well preserved though stained a light yellowish color, and the deep red matrix, which penetrates septal pores and even the alveoli of the walls, reveals structural details very clearly. But in normal photographs of thin sections the matrix appears black and the shell features are obscured. Filters give little improvement. We therefore tried making negative prints directly from the specimens on bromide paper, with the results shown in figures 1 to 9.

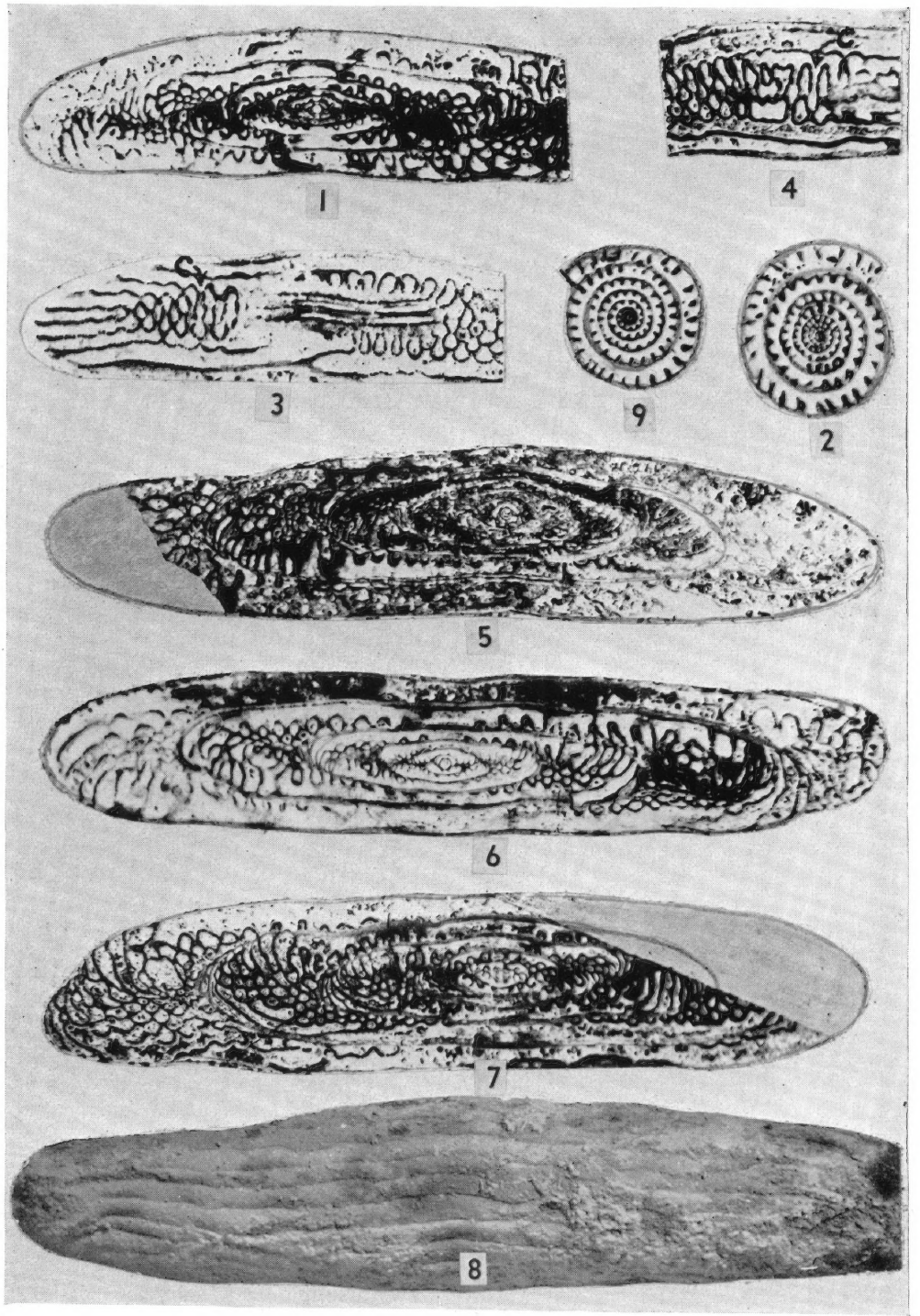
The stage of evolution represented almost certainly indicates an Artinskian age. The presence of cuniculi would indicate that it is younger than Wolfcamp, while their primitive stage of development shows that they are older than Guadalupian. Furthermore, the mode of occurrence suggests Artinskian rather than Sakmarian or Wolfcamp age. In the latter series a variety of genera commonly consort together, with *Schwagerina*, *Pseudoschwagerina*, and *Triticites* dominant, but in the Leonard and Artinskian the variety is greatly reduced, and large, subcylindrical species predominate, commonly occurring alone as in the specimen before us.

Parafusulina alaskensis, new species

Figures 1–9

DESCRIPTION: A subcylindrical species developing about six volutions and attain-

[1] 1908, U. S. Geol. Surv. Bull. 347, pl. 1.



Figs. 1–9. *Parafusulina alaskensis*, new species, A.M.N.H. No. 26235. 1, 5–7, Axial sections. 2, 9, Sagittal sections. 3, 4, Tangential facets near the floor of the outer whorl, showing evidence of the cuniculi (c). 8, External view of the holotype, showing septal furrows. All figures × 10.

ing a length of 12.8 to 13.0 mm. and a diameter of 2.5 to 2.7 mm. The form ratio increases rapidly during growth, as indicated in the table of measurements, until the length at maturity is about five times the thickness.

The proloculus is commonly between 140 and 200 microns in diameter, and its wall is only 15 to 20 microns thick. The spiral wall is thin also in the first two volutions but thickens gradually to about 85 microns in the outer whorls and rarely more. It is rather coarsely alveolar, and the filling of hematite in the type specimens commonly makes the alveoli conspicuous.

The septa are relatively widely spaced, increasing from about 10 in the first whorl to about 25 in the sixth. Septal folds are slight near the outer margin but become strong in the inner half where opposed folds of adjacent septa meet and fuse. Low, slender cuniculi appear in the third or fourth volution and are well developed in the outer whorls (figs. 3 and 4), though they remain low and narrow. In axial sections the septal loops appear relatively low and irregular. Septal pores are abundant throughout the shell and in the material before us are strikingly emphasized by the red matrix.

The tunnel is relatively wide in all the whorls. Some of the irregularity in the tunnel angle in successive whorls may be in part due to inaccurate measurement, for, in the absence of chomata, it is commonly difficult to be certain of the margins of the tunnel in thin axial sections. Nevertheless, the measurements for the holotype (specimen no. 1) are accurate, for they were made on a polished median surface in which the limits of the tunnel are clearly visible.

The holotype is illustrated as figure 8 and is recorded as specimen no. 1 in the table of measurements. After photographing, the specimen was cut down from the back side to the median plane, and the preservation is, fortunately, so good that full data on the internal structure could be secured without reducing it to a thin section.

In the following table, statistical measurements are given for seven specimens. The horizontal line marked zero represents the proloculus, and the others represent successive volutions of the shell. Specimens numbered 1, 2, 3, 4, 5, and 6 are illustrated as figures 8, 5, 1, 6, 2, and 9, respectively.

TABLE OF MEASUREMENTS

Volution	Half Length				Radius Vector				Form Ratio			
	1	2	3	4	1	2	3	4	1	2	3	4
0	.06	.09	.07	.08	.06	.09	.07	.08	—	—	—	—
1	.29	.46	.30	.29	.14	.21	.19	.16	2.1	2.2	1.6	1.8
2	.57	.86	.60	.64	.24	.33	.28	.29	2.4	2.6	2.1	2.2
3	1.08	1.40	1.10	1.27	.36	.46	.41	.43	3.0	3.0	2.7	3.0
4	2.20	2.50	1.90	2.64	.56	.64	.57	.65	4.0	4.0	3.3	4.0
5	3.80	4.10	3.50	4.86	.81	.91	.87	1.01	4.7	4.4	4.0	4.8
6	6.20	6.30	—	—	1.27	1.33	—	—	5.0	5.0	—	—

Volution	Tunnel Angle				Wall Thickness				Septal Count		
	1	2	3	4	1	2	3	4	5	6	7
0	—	—	—	—	.015	.015	.015	.020	—	—	—
1	—	—	42°	40°	.015	.030	.030	.020	10	9	11
2	38°	28°	38°	40°	.020	.043	.035	.035	14	11	14
3	33°	40°	56°	65°	.043	.075	.043	.060	21	14	18
4	53°	53°	58°	77°	.050	.085	.070	.070	20	20	20
5	61°	59°	—	?	.085	.085	—	.085	23	24	25
6	—	—	—	?	.115	.085	—	—	25	28	—

DISCUSSION: Considering the degree of its septal specialization, this species represents the Leonard (=Artinskian) stage of the Permian. The presence of cuniculi indicates a post-Wolfcamp age, but the late development of these in the ontogeny of the shell and their small size at maturity show that this is an early species of the genus *Parafusulina*. There are no described American forms closely resembling it.

Schwagerina lutugini (Schellwien) of the Russian Artinskian is similar in shape and about equal in size. A modern and detailed description of that species is needed. No cuniculi were observed, however, by Rauser-Chernoussova who suggested that it might represent a stage ancestral to *Parafusulina*.

Our species agrees closely with *Parafusulina subextensa* Chen of the Chihsia limestone of China in size, shape, and number of volutions, but its proloculus is only about half as large as in Chen's species and its tunnel is relatively wider. Chen's description and illustrations are inadequate to indicate the degree of development of the cuniculi in his species.

Parafusulina kattaensis (Schwager) of the lower part of the Productus limestone in the Salt Range of India is also remarkably similar in size and shape to the Alaskan species, and it, too, has the septal folds chiefly limited to the lower (inner) part of the septa and has rather primitive cuniculi. It also has a wide tunnel, as in our species, and a spiral wall of comparable thickness. The most obvious difference appears to be that *P. kattaensis* tends to develop a considerable amount of axial filling which is entirely lacking in *P. alaskensis*.

Types in the American Museum of Natural History.

OCCURRENCE: Unnamed beds of the Artinskian stage of the Permian on Kuiu Island, south of Sitka, Alaska.